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Subject: Devils Head Electronic Site Fuels Reduction Project

To: District Ranger, Peaks RD, Coconino NF

On May 31, 2007, we visited the Peaks RD, Coconino NF, at the request of Andy Stevenson, District Silviculturist, to discuss and evaluate the Devils Head Electronic Site Fuels Reduction Project on the District. We describe in this report what insect and disease activity was observed in this area, general existing stand conditions, and make recommendations to minimize impacts caused by insects and diseases.

Devils Head Electronic Site Fuels Reduction Project

The primary objective of the project is to reduce fuels and decrease fire hazard that could threaten structures and equipment at this site. In addition, thinning may improve forest health conditions, reduce dwarf mistletoe, improve stand and individual tree resilience and vigor, and improve vegetative species diversity. Trees directly adjacent to buildings, towers and other telecommunication equipment will be removed on 3.3 acres. An additional 16.3 acres of mixed conifer forest will be thinned in the surrounding project area. Proposed treatments include non-commercial thinning of mixed conifer trees (ponderosa pine, southwestern white pine, Douglas-fir, white fir) up to 9 inches in diameter.

We conducted a brief walk through survey of the proposed treatment areas to look for root disease, dwarf mistletoe, bark beetle activity and general stand conditions. The area to be thinned has moderate to dense tree stocking levels (***Figure 1***). These are uneven aged mixed conifer stands with a dense sapling to pole-size component (4 to 12 inch diameter) and scattered larger pine in the overstory.

Figure 1. *Stand conditions at the Devils Head Communication Facility.*

Douglas fir dwarf mistletoe (*Arceuthobium douglasii*) is dispersed throughout the project area; ranging from groups of severely infected Douglas fir trees to groups showing

little to no infection. Douglas fir dwarf mistletoe causes the host to form large witches' brooms composed of very flammable fine branching that add to the high fuel loads found in the project area.

Mortality of dwarf mistletoe infected Douglas fir is likely related to a higher incidence of Douglas-fir beetle (*Dendroctonus pseudotsugae*). Based on a recent study on the San Francisco Peaks and elsewhere in Arizona, Douglas-fir beetle appears to focus its initial attacks on trees infected by dwarf mistletoe and root disease (e.g., *Armillaria* spp.), which are more common in higher elevation forests (McMillin and Fairweather, unpublished data). Armillaria root disease was observed during our walk through of Douglas fir trees recently killed by bark beetles and typically infected with dwarf mistletoe; however, there was no evidence of tree mortality due solely to root disease infection. Mortality of Douglas fir in stands severely infested with dwarf mistletoe can be three to four times that of healthy stands (Mathiasen et al., 1990). In Douglas fir, mortality is often greater with lower infection levels than is found for southwestern dwarf mistletoe of ponderosa pine.

Southwestern white pine is dispersed throughout the project area and was checked carefully for the presence of white pine blister rust (*Cronartium ribicola*). This non-native disease has not yet been found in Arizona but is located in New Mexico and California and is known to alternate on the orange gooseberry shrub, which is common in canopy openings in the project area. We did not observe blister rust in the project area.

The project area has experienced low to moderate bark beetle-caused mortality over the past few years. Douglas-fir trees had been attacked by Douglas-fir beetle (***Figure 2***). White fir trees had been previously attacked by the fir engraver (*Scolytus ventralis*), and a limited number of trees exhibited branch flagging which is indicative of fir engraver attack. In addition, during the drive to and from the site, higher levels of Douglas-fir and white fir mortality were observed on the north facing slope of Devils Head (approximately1 to 2 miles from the project site) and along Forest Service Road 557. This mortality was likely caused by bark beetles infesting trees stressed from density competition, drought, and diseases. Recently killed pines within the project area were observed to have been attacked by western pine beetle (*D. brevicomis*). Although some pine engraver beetle activity (*Ips* species) was observed in down material, none was seen in standing trees.

Slash and log treatment options

Several species of bark beetles are known to infest and have population build up in fresh thinning slash, including *Ips* species on ponderosa pine (Parker 1991) and Douglas-fir beetle on Douglas-fir (Furniss and Carolin 1977). Because the project site is at a relatively high elevation, we do not expect *Ips* to become a problem, especially if the thinning is conducted in late summer to early fall time period. Furniss and Carolin (1977) report that slash has not caused large-scale outbreaks of Douglas-fir beetle, but large amounts of logs probably should not be left on site, particularly if they are shaded.

Figure 2. *Douglas-fir tree infested by dwarf mistletoe and attacked by Douglas-fir beetle near communication towers.*

We discussed various options for managing slash to minimize bark beetle-caused impacts. Potential options include chipping of activity slash, decking of large diameter material in certain lower risk locations, burning of log decks and slash, timing of thinning treatments, and use of bark beetle anti-aggregation pheromones to deter bark beetle attack.

Chipping. Chipping of activity slash eliminates it from being host material (Six et al. 2002). However, attacks of residual ponderosa pine by bark beetles have been shown increase in stands that were recently thinned and chipped due to the beetle's attraction to terpene volatiles emanating from fresh chips (Fettig et al. 1996). Studies have not been conducted with Douglas-fir beetle and chips, but they may respond in a similar fashion. Chipping during non-beetle flight periods (i.e., October – January) and maximizing the distance chips are from residual trees should help to reduce any risk.

Placement of logs. Although commercial removal of logs from the mountain is not feasible, there are at least three different alternatives for placement of logs generated from the proposed work. In order of greatest risk to least amount of bark beetle associated risk would include: One, the material could be left on site within treated stands and next to buildings. Two, logs could be decked in an opening to the north of buildings and towers (***Figure 3***). Three, logs and other large diameter material could be moved to the Turkey Park meadow just down the hill from areas to be treated. Logs and large diameter slash left within stands or in the shade of buildings would likely cause the greatest risk because the host material would dry out the slowest. In addition, material left in this area would still add to fuels. The open area to the north of the buildings would help promote drying out of the material and would only require a short moving distance; however, the material would still be in close proximity to standing trees. Placement of the material in Turkey Park would promote the quickest drying, pose the least risk of successful brood development, and significantly reduce the chance of beetle population increase in the area. However, this would require the greatest effort to move material.

Figure 3. *Area for locating log deck and large diameter slash north of communication towers.*

Timing. Andy informed us that the treatments will be implemented towards the end of the summer and early fall. Treatments at this time should help to minimize bark beetle impacts because standing trees typically have suitable soil moisture due to monsoon rains, which should lead to improved individual tree vigor, and bark beetles will also stop dispersing.

MCH. Bark beetles produce both aggregation and anti-aggregation pheromones (chemical messages that the beetles use to communicate). The anti-aggregation pheromone serves to prevent overcrowding of beetles and to optimize their brood's survival. In simple terms, the anti-aggregation pheromone acts as a "no vacancy" signal to late-arriving beetles, causing them to avoid that tree or log. The efficacy of the anti-aggregation pheromone for Douglas-fir beetle (MCH) in disrupting infestations is well documented in the published literature (Ross and

Daterman 1997a, 1997b) and is used operationally (Ross et al. 2001). MCH is packaged in small plastic bubble capsules that are attached to trees or other structures around the perimeter of the area being protected. Increased tree mortality outside the area being protected has not been observed (i.e., no "halo effect"). At this time, MCH treatments have not been fully developed to protect individual trees and its use is only intended for area protection.

MCH could be used to treat log deck area shown in ***Figure 1*** to prevent Douglas-fir beetle from infesting this material in the late spring/early summer of 2008 (cost for material would be approximately $75). Also, could potentially treat 3.3 acres closest to buildings and towers (cost for material would be approximately $200) or the whole 16 acres (cost for material would be approximately $1,000). Timing of MCH is important – would need to be in place by May 15 of 2008.

Burning. Burning of slash piles can be effective at reducing bark beetle risk. While complete consumption of the slash would obviously reduce risk, significant charring of bark on logs and slash will also kill developing brood and decrease the suitability of the slash for brood development. However, burning of activity slash and prescribed ground fires that result in scorching of standing Douglas-fir can create a potential risk for Douglas-fir beetle. Despite their thick bark, mature Douglas-fir often suffer high levels of mortality after fire because Douglas-fir beetles are attracted to trees with moderate amounts of crown scorch (reviewed by DeNitto et al. 2000, Parker et al. 2006). Apparently Douglas-fir beetles prefer trees sustaining more than 50% basal girdling, ample green phloem, and less than 75% crown scorch. Populations of Douglas-fir beetle may increase in burned areas and subsequently attack trees in neighboring unburned areas leading to large-scale outbreaks (McMillin and Allen 2003).

Recommendations

The proposed non-commercial thinning treatments will help lessen risk of catastrophic wildfire in the project area. In addition, the project should decrease dwarf mistletoe inoculum and disease impacts, reduce the overall susceptibility of stands to bark beetle attack in the long term, improve overall tree vigor, and improve vegetative species diversity.

The proposed prescription to thin mixed conifer trees up to 9 inches dbh will help reduce dwarf mistletoe levels since the most severely infected trees in the Devils Head Electronic Site Fuels Reduction Project are smaller diameter trees. Also, since Douglas fir dwarf mistletoe causes the host to form extremely large witches' brooms composed of very flammable fine branching, the removal of these trees will help reduce ladder fuels in the stand. Thinning also creates space between trees which limits dispersal since seeds are explosively discharged at distances average 10 to 40 feet. The proposed treatment will favor ponderosa pine and white pine, which are not hosts of Douglas fir dwarf mistletoe.

Because *Ips* species have historically been more important at lower elevation sites and the mixed species stand conditions present, it does not seem that these species will be a concern at the Devils Head project site. The larger concern is related to the potential for Douglas-fir beetle caused mortality. Based on studies in the Rocky Mountains, Douglas-fir beetle preferentially attack large, old trees in dense stands with a high Douglas-fir component (Furniss et al. 1981, Negrón 1998, Negrón et al. 1999, McMillin and Allen 2003). Active stand management (thinning) provides the best long term prevention or minimizing damage by Douglas-fir beetle

(Schmitz and Gibson 1996), and the fuels reduction project should help to lower stand risk. However, log decks, thinning slash, and subsequent burning may pose a short-term risk to residual trees in the thinning unit or surrounding areas. Timing of thinning treatments, chipping, and placement of potential brood material in open areas should help to minimize potential impacts.

We recommend careful monitoring of Douglas-fir beetle populations associated with this fuel reduction project. Our staff can assist with this monitoring through inspection of logs and slash, ground surveys, and aerial detection surveys. As outlined above, MCH could be used to prevent attacks within part or all of the project area.

If you have any questions regarding our assessment within the project area or our recommendations, please let us know.

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